UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/776,736	02/10/2004	Piet Dewaele	226367	3623

23460 7590 05/15/2008

LEYDIG VOIT & MAYER, LTD
TWO PRUDENTIAL PLAZA, SUITE 4900
180 NORTH STETSON AVENUE
CHICAGO, IL 60601-6731

EXAMINER	
FUJITA, KATRINA R	

ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
05/15/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/776,736	DEWAELE, PIET	
	Examiner	Art Unit	
	KATRINA FUJITA	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 April 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-9,13 and 15-21* is/are pending in the application.

4a) Of the above claim(s) *17,20 and 21* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *17, 20 and 21* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This Office Action is responsive to Applicant's remarks received on April 22, 2008. Claims 1, 3-9, 13 and 15-21 remain pending.

2. In response to applicant's request for reconsideration regarding the previous Office action, the following corrective action is taken:

Specifically, an error in the restriction requirement was made, such that claims 18 and 19 were unconsidered. A revised Office action is provided herein, clarifying the restriction requirement and will include remarks regarding claims 18 and 19.

A new shortened statutory time period of three (3) MONTHS and a new statutory period for reply is restarted to begin with the mailing of this letter.

Election/Restrictions

3. Newly submitted claims 17, 20 and 21 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

- Claims 1-3, 13, 15 and 16 require **direction and magnitude of normal vectors** associated with a curvature to determine the orientation.

- Claims 17, 20 and 21 require **fitting a circle segment to data** and using **a direction of a midpoint of the fitted circle** to determine the orientation.

These patentable differences are mutually exclusive as they are not common to both claim groups and as such are inventive concepts. In addition, these groups are not obvious variants of each other based on the current record.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 17, 20 and 21 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

Should applicant traverse on the grounds that the groups are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the groups to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the groups unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other group.

Specification

4. The previous specification objection has been withdrawn in light of Applicant's amendment.

Claim Objections - 37 CFR 1.75(a)

5. The previous claim objection has been withdrawn in light of Applicant's amendment.

6. The following is a quotation of 37 CFR 1.75(a):

> The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.

7. Claims 18 and 19 are objected to under 37 CFR 1.75(a), as failing to particularly point out and distinctly claim the subject matter which application regards as his invention or discovery.

Claim 18 lacks antecedent basis for "said analyzing coordinate system is quantized" at line 2. However, in claim 6, it is established that the direction and magnitude of the computed first and second derivative vectors are quantized in line 4. Therefore, the following will be assumed for examination purposes: -- said ~~analyzing coordinate system is~~ direction and magnitude of the computed first and second derivative vectors are quantized --. The same applies to claim 19.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 1, 3, 8, 13, 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Chang et al. (“Radiology Image Orientation…”, SPIE Conference on Image Display, which incorporates Glicksman et al. (“Architecture of a High Performance PACS…”, Proceedings SPIE)) and Goris (US 5,970,182).

Regarding **claim 1**, Chang teaches a method to be employed by a computer of determining the orientation of an image (“radiology image orientation processor for workstation display” at section 1, line 3; “image orientation processor is meant to evolve into operational software” at section 2, paragraph 7, line 1) characterized in that the orientation is deduced from a digital representation of the image (“image orientation of digital X-ray images” at section 1, line 4).

Chang does not disclose that the orientation is determined from direction and magnitude of normal vectors associated with local curvature in a set of points.

Goris teaches a method of determining the orientation of an image comprising determining the orientation (“orientation and curvature information” at col. 7, line 45) from direction and magnitude of normal vectors ("where (nx, ny, nz) is the normal vector of S2 at N, and (nx”, ny”, nz") is the normal vector of S1" at M"" at col. 7, line 43) associated with local curvature in a set of points (figure 9B).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the normal vector information of Goris to further define the orientation of Chang to "provide a reliable, operator independent method for the analysis and interpretation of organ images" (Goris at col. 4, line 46).

Regarding **claim 3**, Chang teaches a method wherein the digital representation is an edge representation ("digital chest image is first read in by the algorithm and then segmented into a binary image" at section 3A, paragraph 1, line 1).

Regarding **claim 8**, Chang teaches a method wherein direct exposure areas are excluded from the digital representation ("pixels in lungs as well as the area outside the body are assigned to be 0" at section 3A, paragraph 3, line 7).

Regarding **claim 9**, Chang teaches a method wherein an image is subjected to an orientation modifying geometric transformation ("If the side image is rotated by 90° or -90°, the algorithm will rotate the image" at page 292, paragraph 6, line 1) to yield a desired orientation of the image ("the algorithm assigns the image with notations such as HA, HP, FA or FP" at page 292, paragraph 6, line 2; "the notation used by the algorithm to indicate the patient's orientation" at section 2, paragraph 5, line 2).

Regarding **claim 13**, Glicksman teaches a computer readable carrier medium ("image processing card provides up to 65 MBytes of high speed buffer storage" at section 4, paragraph 4, line 3).

Regarding **claim 15**, Goris discloses a method wherein said orientation is deduced from an addition vector of said normal vectors (equation at col. 7, line 37).

Regarding **claim 16**, Chang discloses a method wherein said image is represented by an iso-intensity representation ("segmented into a binary image" at section 3A, paragraph 1, line 2).

10. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Chang et al. and Goris as applied to claim 1 above, and further in view of Kawata et al. ("Characteristics Measurement for…", Nuclear Science Symposium, which incorporates Sander et al. by reference ("Inferring Surface Trace…", IEEE Transaction)).

The Chang et al. and Goris combination teaches the elements of claim 1 as shown in the 103 rejection above.

The Chang et al. and Goris combination does not teach computing first and second derivative vectors, quantizing the direction and magnitude of computed first and second derivative vectors, weighted voting of quantized first and second derivative directions into analyzing coordinate system orientations so as to determine a maximum vote and selecting the orientation having the maximal vote.

Sander teaches a method comprising:

computing first and second derivative vectors ("model normal" on page 839, denoted as "N(p,q)"; "a", "b", and "c" in the sentence immediately following equation 1),

quantizing the direction and magnitude of computed first and second derivative vectors (equations 2 and 3 on page 839; "||N(p,q)||" on page 840),

weighted voting of quantized first and second derivative directions ("principal curvatures can be computed at all k points" at section VI-D, paragraph 3, page 843) into analyzing coordinate system orientations ("conversion of the principal directions from the (P,Q) system into R^3 image coordinates" at section V-C, paragraph 3, page 841) so

as to determine a maximum vote ("determines the principal direction corresponding to the maximal principal curvature" at section VI-D, paragraph 6, page 844).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the orientation processor of the Chang et al. and Goris combination using the Darboux frame estimation taught by Kawata as described above, to "derive the image understanding of 3D object" (Kawata at section II, paragraph 1, line 13).

11. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Chang et al., and Goris as applied to claim 1 above, and further in view of Kawata and Uppaluri (US 2003/0215119).

The Chang et al., and Goris combination teaches the elements of claim 1 as shown in the 103 rejection above. The Chang et al., and Goris combination also discloses that the image is a thoracic image ("chest images" Chang et al. at section 1, line 4).

The Chang et al. and Goris combination does not teach calculating curvature and basing a decision on the orientation of the image is based on the calculated curvature.

Kawata discloses a method in the same field of endeavor of medical image analysis ("system for three-dimensional image analysis of blood vessels" at section I, paragraph 2, line 1) wherein curvature is calculated ("surfaces representation using curvatures" at section I, paragraph 3, line 4) and a decision on the orientation of said image is obtained based on the value of the calculated curvature ("following functions

are implemented…extraction of the orientation of blood vessels" at section I, paragraph 2, line 5; "functions are based on…surfaces representation using curvatures" at section I, 1, paragraph 3, line 4).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the orientation processor of the Chang et al. and Goris combination using the curvature calculation taught by Kawata as described above, to "derive the image understanding of 3D object" (Kawata at section II, paragraph 1, line 13).

The Chang et al., Goris and Kawata combination does not teach curvature being determined of ribs or the ribcage.

Uppaluri discloses a method in the same field of endeavor of medical image analysis ("method and system for computer aided detection and diagnosis of dual energy ("DE") or multiple energy images" at paragraph 0001, line 3) wherein curvature is calculated ("region of interest statistics such as shape, size, density, curvature can be computed" at paragraph 0034, line 8; figure 6, numeral 230) which is used in a CAD algorithm ("candidate regions are then classified based on features extracted from the corresponding complete image set" at paragraph 0042, line 7; figure 11, numeral 340) on areas that include the ribs ("edges outside the ribs" at paragraph 0046, line 9).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the orientation processor of the Chang et al., Goris and Kawata combination using the feature extraction taught by Uppaluri as described above, "to

separate the edges inside the ribs from the edges outside the ribs, as edges inside the ribs are candidates for fractures" (Uppaluri at paragraph 0046, line 8) and subsequently provide for incorrect image orientation.

12. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Chang et al. and Goris as applied to claim 1 above, and further in view of Kawata and Abdel-Mottaleb (US 5,572,565).

The Chang et al., and Goris combination teaches the elements of claim 1 as shown in the 103 rejection above.

The Chang et al. and Goris combination does not teach calculating curvature and basing a decision on the orientation of the image is based on the calculated curvature.

Kawata discloses a method in the same field of endeavor of medical image analysis ("system for three-dimensional image analysis of blood vessels" at section I, paragraph 2, line 1) wherein curvature is calculated ("surfaces representation using curvatures" at section I, paragraph 3, line 4) and a decision on the orientation of said image is obtained based on the value of the calculated curvature ("following functions are implemented…extraction of the orientation of blood vessels" at section I, paragraph 2, line 5; "functions are based on…surfaces representation using curvatures" at section I, 1, paragraph 3, line 4).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the orientation processor of the Chang et al. and Goris combination using the curvature calculation taught by Kawata as described above, to

"derive the image understanding of 3D object" (Kawata at section II, paragraph 1, line 13).

The Chang et al., Goris and Kawata combination does not teach a mammographic image and curvature is calculated for skin border edge segments of the image.

Abdel-Mottaleb discloses a method in the same field of endeavor of medical image analysis ("method of and system for segmenting digital mammograms" at col. 3, line 56) wherein curvature is calculated for skin border edge segments ("segment of the skinline of greatest curvature is selected" at col. 4, line 36) of a mammographic image ("digital mammograms" at col. 3, line 57) to detect the nipple in the image ("detected reference point corresponding to the nipple" at col. 7, line 45).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the orientation processor of the Chang et al., Goris and Kawata combination using the skinline extraction taught by Abdel-Mottaleb as described above, to "assure that equal amounts of tissue, between skinline and chest wall, are visualized in all views taken" (Abdel-Mottaleb at col. 2, line 58).

13. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Chang et al. and Goris as applied to claim 1 above, and further in view of Pietka ("Image Standardization in PACS", Handbook of Medical Imaging).

The Chang et al. and Goris combination teaches the elements of claim 1 as shown in the 103 rejection above.

The Chang et al. and Goris combination does not teach excluding collimation areas from the digital representation of the image.

Pietka discloses a method in the same field of endeavor of medical image enhancement ("image content adjustment to make images more readable…in preparation for medical diagnosis" at section 1, paragraph 2, line 6) wherein collimation areas are excluded from an image ("removal of collimator-caused background" at section 2, paragraph 2, line 3).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the orientation processor of the Chang et al. and Goris combination using the background removal taught by Pietka as described above, to provide "lossless data compression" (Pietka at section 2.1, paragraph 5, line 3).

14. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Chang et al., Goris and Kawata et al. as applied to claim 6 above, and further in view of Pulsipher et al. (US 5,943,446).

Regarding **claim 18**, the Chang et al., Goris and Kawata et al. combination discloses a method wherein said image is a 2D image ("image size is 440 x 535" at page 287, section A, paragraph 2, line 3).

The Chang et al., Goris and Kawata et al. combination does not disclose that said direction and magnitude of the computed first and second derivative vectors are quantized according to four Cartesian plane quadrants.

Pulsipher et al. teaches a method in the same field of endeavor of image vector quantization ("method of increasing the speed of performing a full code book search during vector quantization" at col. 1, line 10) wherein said direction and magnitude of the computed vector is quantized ("must determine the quadrant of the first four axis system in which the text vector lies" at col. 6, line 64; "sublists associated with each of the cells of the lattice which covers a full image being quantized" at col. 2, line 11) according to four Cartesian plane quadrants ("four axis coordinate system 68" at col. 6, line 52).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the four axis coordinate system of Pulsipher et al. to quantize the first and second derivative vectors of the Chang et al., Goris and Kawata et al. combination as it "greatly increases the speed of a full code book search" (Pulsipher et al. at col. 1, line 44).

Regarding **claim 19**, the Chang et al., Goris, Kawata et al. and Pulspiher et al. combination discloses the elements of claim 18 as described in the 103 rejection above.

The Chang et al., Goris, Kawata et al. and Pulspiher et al. does not explicitly disclose using eight Cartesian space octants.

However, Pulsipher et al. recognizes the ability to use the application for three dimensional images ("it will be appreciated that the same rules may applied to extend to

three dimensions" at col. 6, line 42). Accordingly, as the Cartesian space is divided into quadrants in two dimensions, it follows that it is divided into octants in three dimensions.

Therefore, it would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the eight axis coordinate system of Pulsipher et al. to quantize the first and second derivative vectors of the Chang et al., Goris and Kawata et al. combination as it "greatly increases the speed of a full code book search" (Pulsipher et al. at col. 1, line 44).

Response to Arguments

Summary of Remarks (@ response page labeled 7): The examiner has not established that there is a burden to examine the newly added claims.

Examiner's Response: In the previous Office Action, the examiner highlighted the fact that the new claims contained patentable differences. The examiner has further elaborated on the restriction requirement to make the reasons clear.

Summary of Remarks (@ response page labeled 7): The restriction of claims 18 and 19 is improper.

Examiner's Response: The examiner has withdrawn the restriction on claims 18 and 19.

Summary of Remarks (@ response page labeled 8): The Goris reference does not disclose how orientation of an image may be determined from the normal vectors.

Examiner's Response: The cited distance measure is utilized in a global affine transformation, which includes processing to determine orientation of the target surface in relation to the template surface. As shown above, the distance measure utilizes information from the normal vectors.

Conclusion

15. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KATRINA FUJITA whose telephone number is (571)270-1574. The examiner can normally be reached on M-Th 8-5:30pm, F 8-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Katrina Fujita/
Examiner, Art Unit 2624

/Vikkram Bali/
Supervisory Patent Examiner, Art Unit 2624